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MATHEMATICS CLUBS IN THE HIGH SCHOOL.

By C. A. Snell.

It is barely possible that some of you have so many high-school clubs and societies, with the effects of which you have to contend, that the suggestion of another club may not meet your approval. The kind of club, however, that I have to describe to you is based upon scholarship, proficiency and interest in mathematics and, from its very nature, would not attract the element that enjoys "adding tone" to societies.

As a matter of fact, if the teacher has time enough to spare from the required work in the mathematics courses, the club work could be carried on in the class room. But, in many high schools where a large per cent. of pupils are fitting for college, and in special fitting schools there is little time for other than the required work for admission to colleges.

In presenting this subject of mathematics clubs in the high school, I am, with your permission, going to refer to the work of our mathematics club in Melrose, which we formed a year and a half ago. We felt that an organization of boys and girls who had manifested ability and interest in mathematics would stimulate a desire for further development individually, and would furnish an opportunity for expression of individual ideas and opinions, and for applications of theory. Furthermore it was thought that a certain standard of attainment, required for admission to the club, might be set up for beginners in high-school mathematics.

That the latter has had effect was shown last fall when a boy applied for admission to the club. On looking up his record it was found that the average attainment in his first two years' work was not high enough to admit him. "Well," said he, "I could have done a great deal better if I had known this club was to be organized."

It does not always follow that a certain marking is adhered to. If a pupil has shown the right attitude toward his work in mathematics and has developed a certain skill and ingenuity for construction, and a certain amount of executive ability, his admission is ruled on by the society. I believe if a boy has anything to offer or to receive from a club of this kind he should not be deprived of the opportunity to express his ideas, or to develop along a line in which he has some natural aptitude.

The charter members of our club were juniors and seniors who had elected mathematics and had attained an average therein of 85 per cent. That standard for admission they still maintain, but exceptions, as I previously stated, are ruled upon. This year they have admitted members from the sophomore, or second-year class, whose standard up to April 1 would warrant their admission.

After becoming a member of the club, if a pupil drops below the average of 80 per cent. in his mathematics, he is given a month's notice to bring up his work or he will be dropped from membership. The chairman of the membership committee interviews the teachers as to the standards of the members, and thereupon notifies anyone who may be neglecting to keep up the standard set. The mathematics teachers and the principal are associate members and are always welcome to any club meetings.

The officers are the president, a boy chosen from the senior class, a first and a second vice-president, secretary and treasurer, and three executive committees. They have drawn up a constitution which states that the first vice-president shall be chairman of the *student aid committee,* and the second vice-president shall be chairman of the *program committee;* the third executive committee is the membership committee, already mentioned.

Their meetings are held once a month, and, after the business, is in the hands of the program committee. The club numbers about forty active members, both boys and girls. There was some difference of opinion at first as to whether or not girls should be admitted to the club, but decision was finally made in their favor, and up to the present time no girl has been dropped from membership on account of deficiency in mathematics.

Their programs consist of subjects chosen with reference to their mathematical or scientific interest. Various members are particularly interested in one phase or another and they are always willing to present their favorite topics. They have a small mathematics library and they also draw material from current magazines. The mathematics teacher occasionally furnishes a topic for their programs. Considerable time is spent in mathematical recreations: one boy has just constructed a small adding machine; a girl wrote a most creditable play in blank verse, which fifteen of the boys presented at their mid-year reunion. A certain portion of time is devoted to considering mathematical subjects not offered in the school curriculum. Occasionally a speaker on some mathematical or scientific subject meets with the club. The members have greatly enjoyed Professor Ransom and Mr. Power, of Tufts, who have kindly presented subjects of unusual interest.

They have designed a pin which consists of a circle inscribed in an equilateral triangle. Within the circle is the figure of the Pythagorean theorem and the Greek word "Ενκλείδης" for Euclidean, the name of their club.

Perhaps the most essential feature of the club, to the teacher at any rate, is the work of the student aid committee. This is a committee made up of twelve or fifteen members of the club, who are appointed to assist the teachers of the mathematics department. On such occasions backward pupils can be given more careful assistance and those who wish to make up work lost by absence may receive individual attention.

Again, some of the most proficient members of the club have been entrusted to correct papers for the teacher, and in one or two instances have taken classes in the absence of a teacher. Two or three have tutored beginners, and last year one of the senior girls tutored a classmate, with the result that the latter passed her entrance examination in algebra for Simmons.

In consideration of this talk, I asked for an expression of opinion from the members present at the last meeting of the club on the question: "What advantage has the mathematics society been to you and in what particular phase of the work have you been interested?"

The president of the senior class said:

"The mathematics club has helped me in three distinct ways: First, it has given me a knowledge of the less common geometrical and algebraic problems and the easier methods of working out those problems. Second, it has brought me into contact with other fellows interested in scientific and mathematical work, and third, it has enabled me to know of new inventions by hearing pupils give talks about them; therefore, I am better able to understand lectures given on science and mathematics and to comprehend articles written on these subjects."

Another wrote: "I have become more interested in geometry than ever before."

A third said: "The mathematics society has given me something to study for."

A fourth said: "I enjoy the freak geometry theorems."

On asking different members of the student aid committee what benefit they have derived from helping others, I received the following replies:

"I enjoy what I have done on the student aid work: it has helped me to review my work and has given me a real desire to teach geometry."

Another said: "New ideas are brought to my mind and I find wherein I am weak in mathematics."

Still another wrote: "Working on the student aid committee has taught me to be more accurate in my own work."

From those who have been helped by the committee I have received the following: "I think I sometimes receive more help from the students than from the teacher, for I feel freer to ask as many questions as I like, whereas I would feel diffident in asking a teacher."

A second stated: "I have never been helped by the teacher so I cannot compare the teacher with the student helper, but I can say that the one who helped me cleared up everything I did not understand."

A third: "I think a student can help another in a great many cases where perhaps a teacher cannot. Often the teachers have gone over the different parts of the subject so much that they do not realize the difficulty of a beginner, but a student who has just mastered the points can realize better where the difficulty lies."

One boy expressed himself: "A fellow near your own size and age doesn't think you are so much of a lunk head when you ask all the questions you want to."

One reply showed quite another phase: "They didn't help me much because I wouldn't let them. I wanted to help myself."

Several very loyally expressed themselves to the effect that no pupil's help could equal that of the teacher's, and one quite correctly explained his statement by adding: "The helper *tells what he* knows, while the *teacher teaches* the pupil to know for himself."

These illustrate a few instances where, I think, a student can, under the supervision of the teacher, be of great assistance, and, at the same time, strengthen his own grasp of the subject.

The advantage to a teacher of a trustworthy helper is obvious, especially if the teacher has large or poorly graded classes.

Of course there are certain types of pupils we cannot turn over to student helpers; nevertheless, I am sure that our mathematics teachers agree that the club is very much worth while, not only as an incentive to beginners, but as a most valuable training for those who are active members of the club.

As it was stated in the beginning, a considerable portion of the work done by the club can be carried on in connection with class-room work if time permits. I think it is a general experience of teachers that some degree of recreation is productive of more interest in the subject at hand, and, hence, of better results.

There is a large field for work and creative interest—history and contributions to mathematics and science, debates, an innumerable list of recreations, tricks, puzzles, fallacies, curiosities and constructions. Even if certain questions, technically presented, are beyond their comprehension, their interest and imagination are aroused, their view of things is broadened, and they cannot help but be impressed with the universality of mathematics.

At our last meeting of the year I have proposed that we trace, in an elementary way of course, the laws of mathematics as applied to other high school subjects; that we consider their bearing upon the languages, history, art, etc.

A phase of the club work worth consideration is the offering of prizes for the best examinations passed by beginners of algebra and of geometry, or to the pupil who has made the best progress in his year's work.

To any teachers present who would be interested in "The Pedagogic Value of Recreations," supplemented by a most interesting bibliography, I would suggest an article in the April number of *School Science and Mathematics* on "Recreations in Secondary Mathematics," by Chas. W. Newhall.

The article expresses in a more general and a broader way than I have done, the advantages of stepping aside from the regular routine, even in a most elementary way. If extra time is required of the teacher in forming clubs of the kind I have described, the effort is duly rewarded in the added interest that pupils manifest in their daily tasks.

Whatever the method used in teaching may be, the thing to be desired is a vital interest in the subject studied, and I most heartily recommend the mathematics club as one method of arousing such an interest, and of increasing personal and classroom efficiency.

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